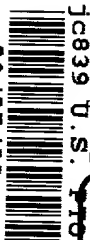


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Jc839 U.S. PTO

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**UTILITY
PATENT APPLICATION
TRANSMITTAL**

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No. 1151

First Inventor or Application Identifier Kishan B. Shah

Title METHOD AND APPARATUS FOR EFFICIENT DETERMINATION OF RECOGNITION PARAMETERS

Express Mail Label No. EL528759599US

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

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1. ☒ * Fee Transmittal Form (e.g., PTO/SB/17)
(Submit an original, and a duplicate for fee processing)
2. ☒ Specification [Total Pages 28]
(preferred arrangement set forth below)
- Descriptive title of the invention
- Cross References to Related Applications
- Statement Regarding Fed sponsored R & D
- Reference to Microfiche Appendix
- Background of the invention
- Brief Summary of the invention
- Brief Description of the Drawings (if filed)
- Detailed Description
- Claim(s)
- Abstract of the Disclosure
3. ☒ Drawing(s) (35 U.S.C. 113) [Total Sheets 3]
4. Oath or Declaration [Total Pages 3]
a. ☒ Newly executed (original or copy)
b. ☐ Copy from a prior application (37 C.F.R. § 1.63(d))
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[Note Box 5 below]
i. ☐ DELETION OF INVENTOR(S)
Signed statement attached deleting inventor(s) named in the prior application, see 37 C.F.R. §§ 1.63(d)(2) and 1.33(b).
5. ☐ Incorporation By Reference (useable if Box 4b is checked)
The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered to be part of the disclosure of the accompanying application and is hereby incorporated by reference therein.
6. ☐ Microfiche Computer Program (Appendix)
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8. ☒ Assignment Papers (cover sheet & documents)
9. ☐ 37 C.F.R. § 3.73(b) Statement (when there is an assignee) ☐ Power of Attorney
10. ☐ English Translation Document (if applicable)
11. ☐ Information Disclosure Statement (IDS)/PTO-1449 ☐ Copies of IDS Citations
12. ☐ Preliminary Amendment
13. ☒ Return Receipt Postcard (MPEP 503)
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38,164

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METHOD AND APPARATUS FOR EFFICIENT DETERMINATION OF
RECOGNITION PARAMETERS

Attorney Docket Number

1151

Express Mail Label Number

EL528759599US

Inventor

Kishan B. Shah

Field of the Invention

10 The present invention is related to computer software
and more specifically to computer software for optical
recognition of objects.

Background of the Invention

15 Computer software can be used to recognize digital
representations of objects. For example, optical character
recognition software can be used to recognize digital
representations of character objects, typically obtained by
scanning a printed page, segmenting the page into
characters, and identifying characteristics of each
20 character. Rules are used to narrow the choice of
characters to a smaller range of characters, and a
confidence level is assigned to each character in the

smaller range. The character with the highest confidence level may be selected as the recognized character.

Some computer software for object recognition uses parameters to allow the software to be adjusted. The use of parameters allows the software to be tuned in a laboratory to particular conditions simulating the environment of anticipated operation of the software.

Before the software is shipped as part of a product, the parameters are fixed at a constant level that yielded the optimum recognition in the laboratory simulation for that product.

For example, if a scanned image represents the image using pixels, each having a greyscale value of 0-255, one parameter of the optical character recognition software may be to identify which values correspond to a part of the image to be recognized, in order to distinguish that part of the document from the greyscale value of the background.

For example, a document received via a fax that is photocopied onto off-white paper may have text that has a greyscale reading of 200, while the remainder of the page may have a greyscale reading of 100. A printed black and white document may have a greyscale reading of 240 for text and 30 for the remainder of the page. Text on a printed

color document may have a greyscale reading as low as 90
with a greyscale reading of 70 for portions of the
background. These various values may be used to determine
that an optimal cutoff greyscale reading of 150 should be
5 used for the software. While this value provides a good
compromise for high-contrast documents such as most black
and white documents, certain color text on color background
documents simply will not be recognized with this parameter
value. If the parameter were lowered to 80 to accommodate
10 recognition of color documents, some black and white
documents would not be recognized, such as the fax
photocopied onto off white paper.

It would be desirable to have the parameter selection
process vary for each set of objects, such as characters on
15 the page, rather than selecting a single value for each
parameter and using that same value for all objects. This
would allow the parameter values to change for every page
or part of a page, causing the parameters to be optimized
for every circumstance. In the example above, it would be
20 desirable to use a greyscale threshold of 150 for the faxed
document and a threshold of 80 for the color document,
instead of using a value of 150 every time.

While it is possible to make several attempts at recognizing the objects, such as characters in the file, using different parameters for each attempt, and then selecting the attempt that yields the highest recognition confidence, such a process would add too much time to the recognition process to be practical. Although computing power increases every year, because users prefer to use the additional computing power to process images of higher resolution rather than improve the accuracy of the recognition, making several attempts at recognizing an image could take too long to be useful.

What is needed is a method and apparatus that can optimally set the parameters of an optical recognition without significantly adding time to the recognition.

Summary of Invention

A method and apparatus receives a digitized representation of an image at a first resolution, then produces a lower resolution version of the image. The method and apparatus then attempts multiple recognitions on the reduced-resolution version of the image using different parameters for each recognition and records the confidence level of the attempt. The parameters that yielded the highest confidence level on the attempt using the lower

resolution version can then be used to perform the
recognition on the higher-resolution version of the image.

Brief Description of the Drawings

Figure 1 is a block schematic diagram of a
5 conventional computer system.

Figure 2 is a block schematic diagram of a system for
identifying optimal parameters for optical object
recognition according to one embodiment of the present
invention.

10 Figure 3 is a flowchart illustrating a method of
identifying optimal parameters for optical object
recognition according to one embodiment of the present
invention.

Detailed Description of a Preferred Embodiment

15 The present invention may be implemented as computer
software on a conventional computer system. Referring now
to Figure 1, a conventional computer system 150 for
practicing the present invention is shown. Processor 160
retrieves and executes software instructions stored in
20 storage 162 such as memory, which may be Random Access
Memory (RAM) and may control other components to perform
the present invention. Storage 162 may be used to store
program instructions or data or both. Storage 164, such as

a computer disk drive or other nonvolatile storage, may provide storage of data or program instructions. In one embodiment, storage 164 provides longer term storage of instructions and data, with storage 162 providing storage for data or instructions that may only be required for a shorter time than that of storage 164. Input device 166 such as a computer keyboard, mouse, scanner, digital camera or any or all of these allows user input to the system 150. Output 168, such as a display or printer, allows the system to provide information such as instructions, data or other information to the user of the system 150. Storage input device 170 such as a conventional floppy disk drive or CD-ROM drive accepts via input 172 computer program products 174 such as a conventional floppy disk or CD-ROM or other nonvolatile storage media that may be used to transport computer instructions or data to the system 150. Computer program product 174 has encoded thereon computer readable program code devices 176, such as magnetic charges in the case of a floppy disk or optical encodings in the case of a CD-ROM which are encoded as program instructions, data or both to configure the computer system 150 to operate as described below.

In one embodiment, each computer system 150 is a conventional Intel Pentium/Celeron compatible computer such

as the model 6540C commercially available from Hewlett
Packard Corporation of Palo Alto, California, running the
Windows operating system commercially available from
Microsoft Corporation of Redmond Washington, although other
5 systems may be used.

Referring now to Figure 2 a system for identifying
optimal parameters for optical object recognition is shown
according to one embodiment of the present invention. The
description below uses characters as the objects, however,
10 objects can be shapes, people, three-dimensional items or
any other object. Native resolution image storage 210
receives at input 208 a digitized representation of an
image from an optical scanning device such as a scanner or
digital camera at input 208. Native resolution image
15 storage 210 contains conventional memory such as random
access memory or other types of storage and stores the
digitized representation of the image in this storage. As
native resolution image storage 210 receives an image, it
signals downsampler 212.

20 In one embodiment, the digitized representation of the
image stored in native resolution image storage 210 is made
up of an array of pixels at a resolution. For example, the
digitized representation of the image may be represented

with a resolution of 1200 x 1200 pixels per inch. Thus, an 8.5 by 11 inch document may be represented by 134,640,000 pixels. The digitized representation of the image may be stored using conventional compression techniques, so the number of pixels stored in native resolution image storage **210** may be less than the 134,640,000 pixels for that size document, even though that many pixels are represented by the digitized representation of the image. Each of the pixels may have one or more values. A greyscale image may have a greyscale value. A color image may have a pair of values: one representing luminance or intensity, and another value representing chrominance or color.

Downsampler **212** retrieves the digitized representation of the image from native resolution image storage **210**, reduces the resolution, and stores the result into low resolution image storage **214**. Downsampler **212** reduces the resolution by selecting a set of pixels, computing an average representation of the value or values of the pixels in the set, and then representing the entire set of pixels selected by a single pixel (or a number of pixels fewer than the number of pixels in the set) having the average value or values of the set of pixels selected. If the digitized representation of the image is compressed, downsampler **212** decompresses the image before reducing the

resolution and may optionally compress the result prior to storage into low resolution image storage **214**.

For example, if the resolution is 1200 dpi and it is desired to reduce the resolution to 300 dpi, downsampler

5 **212** selects from native resolution image storage **210** a set of sixteen pixels from the upper left hand corner of the image, four pixel columns wide and four pixel rows tall, and averages the values from these pixels to produce a single pixel, which is output to low resolution image

10 storage **214**. Low resolution image storage **214** contains conventional storage such as memory or disk storage. The four pixels adjacent to these in each of the same four rows are selected and the process is repeated by downsampler **212** and so on until the end of the row is reached. When the

15 end of the row is reached, downsampler **212** selects the next four rows and repeats the process described above for these rows. It isn't necessary to proceed step-by-step in this fashion, nor is it necessary to average the values. For example, the values may be smoothed using conventional

20 smoothing techniques. When downsampler **212** has completed reducing the resolution of the digitized representation of the image, downsampler **212** signals parameter selector **220**.

Parameter selector **220** selects an initial set of one or more parameters and passes them to recognition engine **216**. Recognition engine is any conventional recognition engine such as an optical character recognition engine that can accept a set of parameters, identify a segment of an image, and provide the one or more characters recognized at the highest confidence level and also supply that confidence level, which may be a value between 0 and 1.

Recognition engine **216** performs conventional optical character recognition techniques using the parameters provided by parameter selector **220** on the reduced resolution version of the digitized representation of the image that is stored in low resolution image storage **214**.

In one embodiment, recognition engine **216** segments the image into characters or words and then attempts to recognize the character or word using conventional optical character resolution techniques on each segment. Optical character recognition is described in Bunke & Wang, ed.,

Handbook of Character Recognition and Document Image

Analysis (1997 World Scientific Publishing Co. Pte. Ltd, Singapore, ISBN 981-02-2270-X). Other forms of object recognition may also be used such as handwriting recognition, described in S Impedoio and J Simon, eds. *From Pixels to Features III*" (1992 Elsevier Science Publishers,

B.V., Amsterdam). Source code for an optical character recognition engine is publicly available from the National Institute of Standards and Technology, Gaithersburg, Maryland, 20899 and is described in Garriss et al, "Public Domain Optical Character Recognition", *Proceedings, SPIE* Volume 2422, pp2-15, and this engine may be suitably modified as described herein.

Parameter selector **220** selects another set of parameters and passes them to recognition engine **216** and signals recognition engine to repeat the recognition process described above on the same segment of the image it just processed, and recognition engine **216** complies with the request. This process may be repeated a number of times, each time with a different set of parameters.

In one embodiment, each time another set of parameters is selected and provided by parameter selector **220**, the value of only one of the parameters is varied until several different values of that parameter have been selected and provided to recognition engine **216** by parameter selector **220**. When all possible values of that parameter have been provided or when an acceptable value has been identified, that parameter is set to a particular value and the value

of a different parameter is varied, and so forth until all the parameters have been varied.

For example, assume two parameters, parameter 1 and parameter 2, with possible values of A1, B1, C1 and D1 for parameter 1 and values A2 and B2 for parameter 2. The sets of parameters provided by parameter selector 220 could be (A1, A2), (B1, A2), (C1, A2), (D1, A2), (A1, B2), (B1, B2), (C1, B2), (D1, B2).

It is not necessary to provide all possible values: for example, a binary search technique may be used or a discrete set of parameter combinations may be provided with multiple parameters changing from one set of parameters to the next. For example, the parameter values provided by parameter selector 220 could be limited to (A1, A2), (B1, B2), (C1, A2), (D1, B2).

Each time the parameters are provided to recognition engine, parameter selector 220 provides those parameters or an indicator of the parameters to optimal parameter identifier 222. In addition, recognition engine provides the confidence level of the character recognition to optimal parameter identifier. Optimal parameter identifier 222 records the parameters and the confidence level so that the optimal value for the parameters may be identified by

selecting values of parameters that yield the highest confidence levels.

In one embodiment, optimal parameter identifier identifies the optimal value for a parameter by choosing
5 the value of a parameter that yielded the highest confidence level for the recognition performed by recognition engine **216**. In another embodiment, if the confidence level exceeds a threshold, such as 0.95, optimal parameter identifier **222** signals parameter selector **220** to
10 select no further values of that parameter. This way, if an acceptable value is reached, the system **200** does not continue searching for a better one: the acceptable value is used as the optimal value.

In one embodiment, when an optimal value for a
15 particular parameter has been identified, optimal parameter identifier **222** provides the value of the optimal parameter to parameter selector **220** to use in all remaining parameter selections it makes as described above. In another embodiment, a preset value may be used in place of the
20 optimal parameter for use in attempting to identify the optimal value of a different parameter.

When the optimal values of all of the parameters have been identified as described above, optimal parameter

storage 210 using the same parameters as the last segment,
and only signals parameter selector 220 to begin the
process of parameter selection again if the confidence
level of the recognition for the segment falls
5 significantly below the confidence level of the last
recognition or falls below a certain preset value.

Referring now to Figure 3, a method of identifying
optimal parameters for optical object recognition is shown
according to one embodiment of the present invention. The
10 description below uses characters as objects, but an object
may also be noncharacter things as described above. An
digital representation of an image is received and stored
310 at a first resolution, such as a native resolution of a
scanning device as described above. A reduced-resolution
15 version of some or all of the image received in step 310 is
produced and stored 312 as described above. A segment is
selected 314, either from the image received in step 310 or
the version of the image produced in step 312. An initial
set of parameters are selected 316 as described above. An
20 attempt is made to recognize one or more objects such as
characters in the segment from the reduced resolution
version of the image, and the highest confidence level
obtained from the attempt is produced 318. If there are
additional combinations of parameters 320, a different

combination is selected as described above 322 and the method continues at step 318 using the different combination of parameters. When the selection and testing the recognition from the combinations of parameters is completed as described above 320, the optimal parameters are identified 324 as described above. The segment of the image received in step 310 is then recognized using the optimal parameters 326 and the character or characters recognized from the segment of the image received in step 310 are output 326. If there are more segments 328, the next segment is selected 330 and the method continues at step 316 using the selected segment, and otherwise, the method terminates 332.

In an alternate embodiment of the present invention illustrated by the dashed lines in the figure, when the next segment is selected at step 330, instead of continuing at step 316, the method continues at step 340. At step 340, the segment from the digitized representation of the image received in step 310 is recognized and a confidence level is identified. If the confidence level is acceptable as described above 342, the character or characters recognized in step 340 are output and the next segment is selected 344, and the method continues at step 340.

Otherwise 342, the method continues at step 316 to identify

values of parameters to use for the segment on which the recognition was attempted in step 340 but acceptable recognition confidence was not achieved.

What is claimed is:

1. A method of recognizing at least one object in a digitized representation of an image, comprising:

receiving the digitized representation of the image, the representation having a first resolution;

5 creating a reduced-resolution version of the image responsive to the digitized representation of the image, the reduced-resolution version of the image having a second resolution lower than the first resolution; and

10 identifying a value of each of at least one recognition parameter using the reduced resolution version of the image; and

15 recognizing the at least one object represented in the digitized representation of the image responsive to the value of each of the at least one recognition parameter identified.

2. The method of claim 1 wherein the identifying step comprises:

providing a plurality of sets of values of at least one parameter;

5 for each of the sets of at least one parameter, identifying a confidence level of recognition by attempting

to recognize from the reduced-resolution version of the image the at least one object responsive to the at least one parameter in the set; and

10 selecting at least one of the values of the at least one parameters in the set responsive to the confidence levels identified.

3. The method of claim 2 wherein the selecting step comprises selecting a value of each of at least one parameter corresponding to a highest confidence level from a plurality of the confidence levels identified.

4. The method of claim 2 wherein the selecting step comprises selecting a value of each of at least one parameter corresponding to a confidence level exceeding a threshold.

5. The method of claim 1 wherein the creating step comprises calculating an average of at least one value of a plurality of pixels of the digitized representation of the image.

6. The method of claim 1 additionally comprising recognizing at least one additional object represented in the digitized representation of the image responsive to the value of at least one recognition parameter identified
5 responsive to a confidence level exceeding a threshold.

7. The method of claim 1 additionally comprising:

attempting to recognize at least one additional object
represented in the digitized representation of the image
responsive to the value of at least one recognition
parameter identified, the attempting step comprising
producing a confidence level of the attempt; and

responsive to the confidence level of the attempt
below a threshold:

repeating the identifying step; and

recognizing the at least one object represented
in the digitized representation of the image
responsive to the value of each of the at least one
recognition parameter identified during the repeating
step.

8. A computer program product comprising a computer
useable medium having computer readable program code
embodied therein for recognizing at least one object in a
digitized representation of an image, the computer program
product comprising:

computer readable program code devices configured to
cause a computer to receive the digitized representation of
the image, the representation having a first resolution;

computer readable program code devices configured to
10 cause a computer to create a reduced-resolution version of
the image responsive to the digitized representation of the
image, the reduced-resolution version of the image having a
second resolution lower than the first resolution; and

computer readable program code devices configured to
15 cause a computer to identify a value of each of at least
one recognition parameter using the reduced resolution
version of the image; and

computer readable program code devices configured to
cause a computer to recognize the at least one object
20 represented in the digitized representation of the image
responsive to the value of each of the at least one
recognition parameter identified.

9 The computer program product of claim 8 wherein the
computer readable program code devices configured to cause
a computer to identify comprises:

computer readable program code devices configured to
5 cause a computer to provide a plurality of sets of values
of at least one parameter;

computer readable program code devices configured to
cause a computer to, for each of the sets of at least one
parameter, identify a confidence level of recognition by

10 attempting to recognize from the reduced-resolution version
of the image the at least one object responsive to the at
least one parameter in the set; and

select at least one of the values of the at least one
parameters in the set responsive to the confidence levels
15 identified.

10. The computer program product of claim 9 wherein
the computer readable program code devices configured to
cause a computer to select comprise computer readable
program code devices configured to cause a computer to
5 select a value of each of at least one parameter
corresponding to a highest confidence level from a
plurality of the confidence levels identified.

11. The computer program product of claim 9 wherein
the computer readable program code devices configured to
cause a computer to select comprise computer readable
program code devices configured to cause a computer to
5 select a value of each of at least one parameter
corresponding to a confidence level exceeding a threshold.

12. The computer program product of claim 8 wherein
the computer readable program code devices configured to
cause a computer to creating comprise computer readable
program code devices configured to cause a computer to

5 calculate an average of at least one value of a plurality
of pixels of the digitized representation of the image.

13. The computer program product of claim 8
additionally comprising computer readable program code
devices configured to cause a computer to recognize at
least one additional object represented in the digitized
5 representation of the image responsive to the value of at
least one recognition parameter identified responsive to a
confidence level exceeding a threshold.

14. The computer program product of claim 8
additionally comprising:

computer readable program code devices configured to
cause a computer to attempt to recognize at least one
5 additional object represented in the digitized
representation of the image responsive to the value of at
least one recognition parameter identified, the computer
readable program code devices configured to cause a
computer to attempt comprising computer readable program
10 code devices configured to cause a computer to produce a
confidence level of the attempt; and

computer readable program code devices configured to
cause a computer to, responsive to the confidence level of
the attempt below a threshold:

15 repeat the identifying step; and

recognize the at least one object represented in
the digitized representation of the image responsive
to the value of each of the at least one recognition
parameter identified during operation of the computer
20 readable program code devices configured to cause a
computer to repeat.

~~15.~~ A system for recognizing objects, the system
comprising:

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a downsampler having an input coupled to a system
input operatively coupled for receiving a representation of
5 an image having a first resolution, the downsampler for
producing and providing at an output a reduced-resolution
version of the image responsive to the representation of
the image received at the downsampler input, the reduced
resolution version of the image having a second resolution
10 lower than the first resolution; and

a recognition engine having a first input coupled to
the downsampler output for receiving the reduced-resolution
version of the image and a second input coupled to the
system input for receiving the representation of the image,
15 the recognition engine for:

at least attempting to recognize at least one first object in the reduced resolution version of the image received at the first input, at least one time;

recognizing at least one second object in the
20 representation of the image received at the second input;
and

providing a representation of the at least one object recognized at a first output coupled to a system output.

16. The system of claim 15 wherein:

the system additionally comprises a parameter selector for selecting and providing at an output a plurality of sets of parameters, each set different from at last one of
5 the other sets; and

the recognition engine additionally has a third input coupled to the parameter selector output for receiving the plurality of sets of parameters and the recognition engine performs the attempt on the at least one object at least
10 one time for each of the sets of parameters received at the third recognition input.

17. The system of claim 16:

wherein the recognition engine:

additionally has a fourth input for receiving an additional set of parameters;

5 performs the recognizing responsive to the additional set of parameters;

is additionally for providing a recognition confidence level at a second output responsive to said attempt, for each of the at least one times; and

10 the system additionally comprising a parameter identifier having a first input coupled to the recognition second output for receiving the recognition confidence level for each of the at least one times, and a second input coupled to the parameter selector output for
15 receiving each of the sets of parameters, the parameter identifier for selecting and providing at an output coupled to the fourth recognition engine input the additional set of parameters responsive to the sets of parameters received at the parameter identifier second input and the
20 recognition confidence level for each of the at least one times received at the parameter identifier first input.

18. The system of claim 17 wherein the parameter identifier selects the additional set of parameters additionally responsive to a threshold confidence level.

19. The system of claim 17 wherein:

the at least one time comprises a plurality of times;
and

the parameter identifier selects the additional set of parameters responsive to a confidence level for at least one of the at least one times relative to at least one other confidence level for at least a different of the at least one times.

20. The system of claim 20 wherein the recognition engine additionally recognizes at least one third object in the representation of the image received at the second input responsive to the additional set of parameters and a
5 confidence level corresponding to the at least one third object.

Abstract of the Disclosure

A method and apparatus creates a reduced-resolution version of an image and uses the reduced resolution version to identify recognition parameters. The recognition
5 parameters are then used on the original version of the image to recognize objects such as characters in the image.

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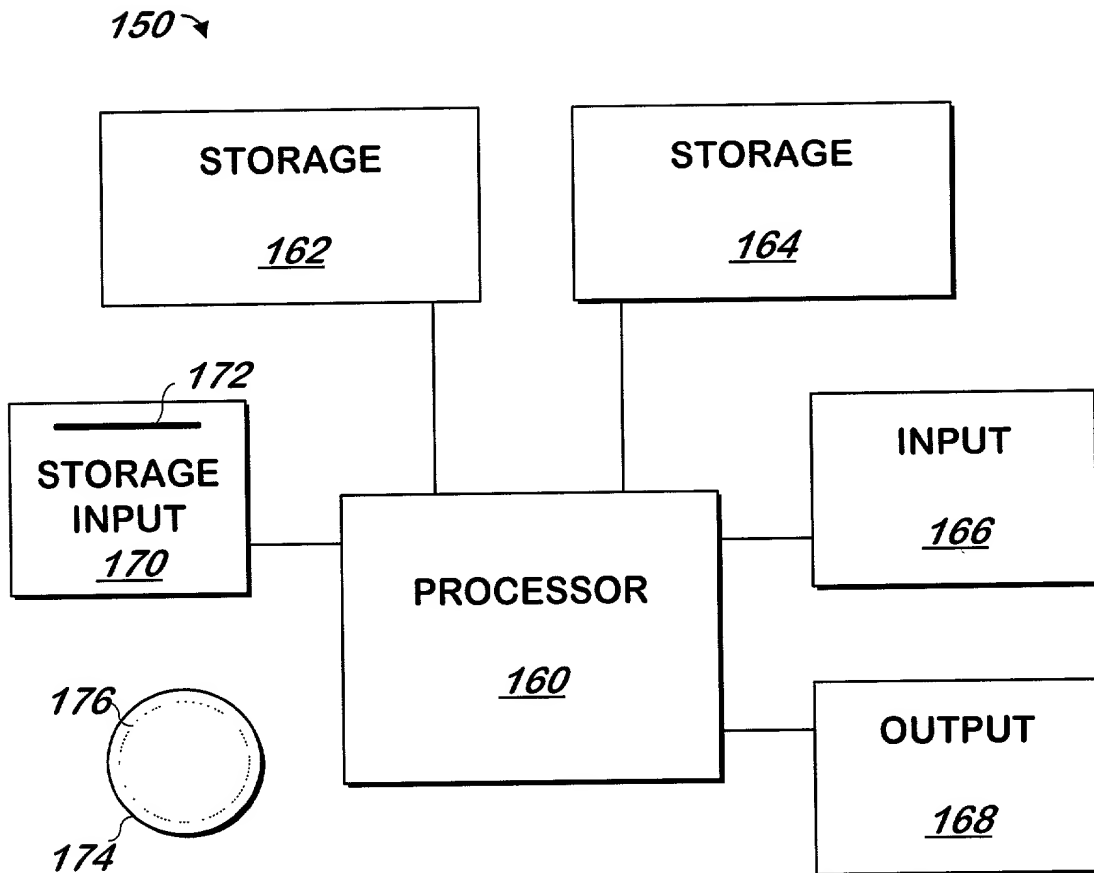
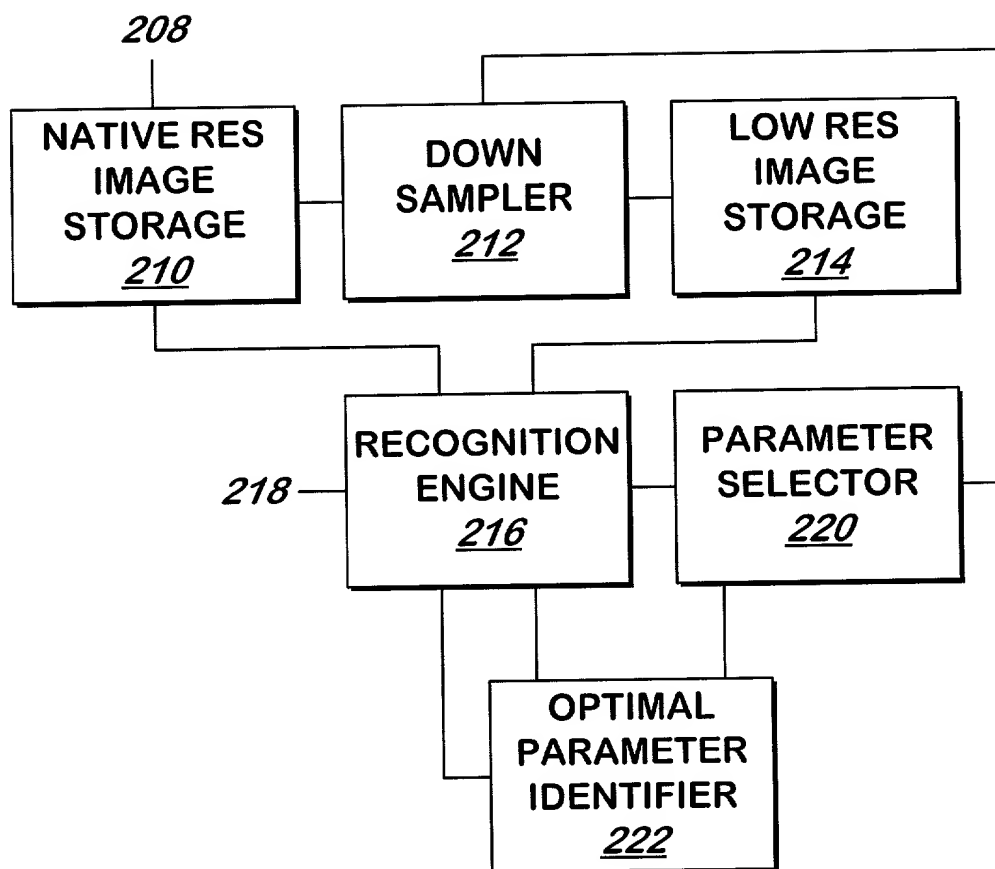
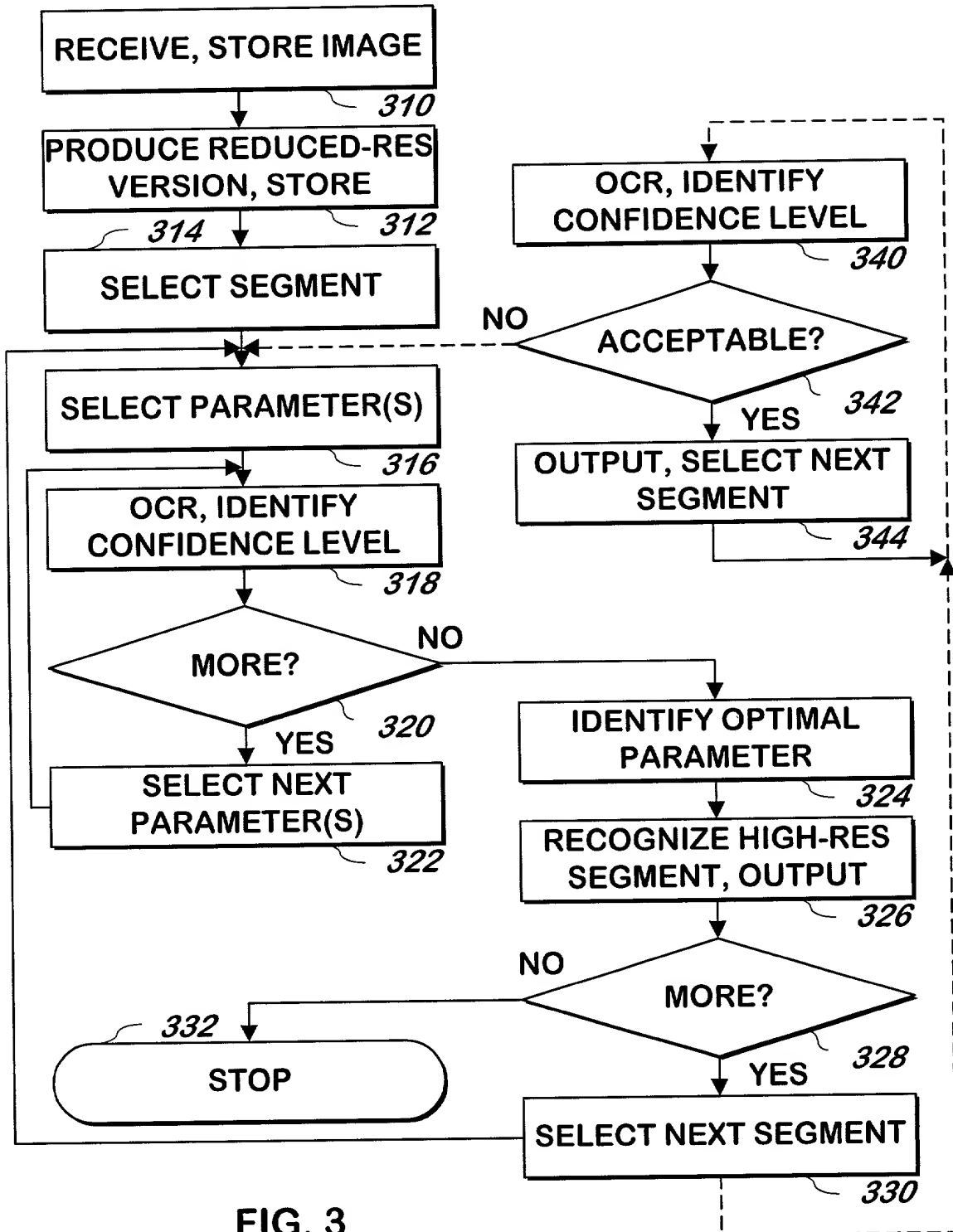


FIG. 1
(PRIOR ART)

**FIG. 2**



Type a plus sign (+) inside this box ->



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Patent and Trademark Office

DECLARATION



Declaration
Submitted
with Initial Filing

OR



Declaration
Submitted after
Initial Filing

Attorney Docket Number

1151

First Named Inventor

Kishan B. Shah

COMPLETE IF KNOWN

Application Number

Filing Date

8/7/2000

Group Art Unit

Examiner Name

As a below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled.

METHOD AND APPARATUS FOR EFFICIENT DETERMINATION OF RECOGNITION PARAMETERS

the specification of which

(Title of the Invention)



is attached hereto

OR



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Application Number

and was amended on (MM/DD/YYYY)

(if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37 Code of Federal Regulations, 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code § 119 (a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or § 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or any PCT international application having a filing date before that of the application for which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Copy Attached?	
			<input type="checkbox"/>	Yes <input type="checkbox"/>	No <input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



Additional foreign application numbers are listed on a supplemental priority sheet attached hereto:

I hereby claim the benefit under Title 35, United States Code § 119(e) of any United States provisional application(s) listed below.

Application Number(s)	Filing Date (MM/DD/YYYY)	<input type="checkbox"/> Additional provisional application numbers are listed on a supplemental priority sheet attached hereto

DECLARATION

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I hereby claim the benefit under Title 35, United States Code § 120 of any United States application(s), or § 365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of Title 35, United States Code § 112. I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations § 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. Parent Application Number	PCT Parent Number	Parent Filing Date (MM/DD/YYYY)	Parent Patent Number (if applicable)

☐ Additional U.S. or PCT international application numbers are listed on a supplemental priority sheet attached hereto.

As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith.

Firm Name Law Offices of Charles E. Gottlieb Payor Number (if applicable) 526-59-8207

Name	Registration Number	Name	Registration Number
Charles E. Gottlieb	38,164		

☒ Additional attorney(s) and/or agent(s) named on a supplemental sheet attached hereto.

☒ Please direct all correspondence to. Name Charles E. Gottlieb

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Address Suite 300

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Country US Telephone 650-328-0100 650-328-2844

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Name of Sole or First Inventor: ☐ A petition has been filed for this unsigned inventor

Given Name	<u>Kishan</u>	Middle Initial	<u>B</u>	Family Name	<u>Shah</u>	Suffix	
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Inventor's Signature Kishan Shah Date 08/03/2000

RESIDENCE: City Mountain View State CA Country US Citizenship Nepal

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City Mountain View State CA Zip 94040 Country US Applicant Authority

☐ Additional inventors are being named on supplemental sheet(s) attached hereto

DECLARATION

ATTORNEY and/or AGENT INFORMATION
(Supplemental Sheet)

[illegible]